



FIG. 9C-15

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```
RiOrPf:=Get_Ri_To_Talk_About(Source,Where);
While (RiOrPf<>'') do
Begin
    If Convert_Ri_To_Pf(RiOrPf) then
        Insert(RiOrPf,Source,Where);
        RiOrPf:=Get_Ri_To_Talk_About(Source,Where);
    end;
end; {convert abstract ris to pfs}
{-----}
PROCEDURE Lower_Case(Var Source: String);
Var I : integer;
Begin
    For I:=1 to Length(Source) do
        If (Source[I]>'@') and
            (Source[I]<'[') then Inc(Source[I],32);
    end; {lower case}
{-----}
FUNCTION Determine_Table(Var S: String): Integer;
Var Temp,Err: integer;
    SubSt : String[10];
Begin
    Temp:=0;
    While (S[Temp+1] in ['0'..'9']) and (Temp<4) do Inc(Temp);
    SubSt:=Copy(S,1,Temp);
    Delete(S,1,Temp);
    If SubSt<>' ' then
        Begin
            Val(SubSt,Temp,Err);
            If Err<>0 then Temp:=0;
        end
    else Temp:=0;
    Determine_Table:=Temp;
end; {determine table}
{-----}
FUNCTION Valid-Token(Var S: String; Var Table: Integer): Boolean;
Var TempSt: String;
Begin
    Table:=-1;
    If S[2] in ['0'..'9'] then
        Begin
            Delete(S,1,1);
            Table:=Determine_Table(S);
        end;
    Valid-Token:=Table>-1;
end; {valid token}
{-----}
PROCEDURE Get_Syn1(Var S: String; Table: Integer);
Var St: String[100];
    Suffix : Boolean;
Begin
    Suffix:=False;
    Case Table of
        {tables 0..10}
        0 : St:=Tired_Terms(false,suffix);
        1 : St:=Signif_Terms(false,suffix);
        2 : St:=A_Bit_Terms(false,suffix);
        3 : St:=Becoming_Terms(false,suffix);
        4 : St:=Possibly_Terms(false,suffix);
        5 : St:=Very_Much_Terms(AnyTerm,false,suffix);
        6 : St:=At_The_Terms(false,suffix);
        7 : St:=Right_By_The_Terms(false,suffix);
        8 : St:=Near_The_Terms(false,suffix);
        9 : St:=Far_From_The_Terms(false,suffix);
        10 : St:=Very_Soon_Terms(false,suffix);
        11 : St:=Moving_Terms(false,suffix);
    end;
    S:=St+S;
end; {Get syn 1}
{-----}
PROCEDURE Get_Syn2(Var S: String; Table: Integer);
Var ST : String[100];
    Suffix : Boolean;
Begin
```

```

end; {expand synonyms}
{-----}
PROCEDURE Convert_Ri_To_Rx(Var Source: String);
(
  Purpose:
    Converts Ri's in user identifier names to the actual Rx's that were used
    in SiMod and decision making.
  History:
    03/27/91 : If RiNum=AnyRi, kick out first SE.Ri.
)
Var RxName,
    RiName      : Str80;
    RiNum,
    RxCount,
    Where, I     : Integer;
    Pt          : PointPtr;
Begin
  RxName:= '';
  RiNum:=0;
  RiName:=Get_Ri_To_Talk_About(Source,Where); {Strip ri from identifier}
  While RiName<>' ' do
  Begin
    Pt:= RiList.Whose_Name(RiName,True,RiNum,i);
    If Pt<>Nil then
      Begin
        RxCount:=RiPtr(Pt)^.Get_Best_Rx_Match(Sxx^,RxName);
        If RxCount=1 then
          Insert(RxName,Source,Where)
        else If (Convert_Ri_To_Pf(RiName)) then
          Begin
            Insert(RiName,Source,Where);
            RxName:=RiName;
          end
        else Insert('<UNKNOWN>',Source,Where);
      end
    else
      If (UpCase_String(RiName)='HIT') then
      Begin
        RxName:=BrainRow^.SxRowRec.RelRow^.SxRowRec.Kind^.RxRec.Name;
        Insert(RxName,Source,Where);
      end
    else
      Insert('<NOHIT>',Source,Where);
      RiName:=Get_Ri_To_Talk_About(Source,Where); {Strip ri from identifier}
    end;
    Expand_Synonyms(Source,255);
  end; {Convert ri to rx}
{-----}
PROCEDURE Convert_Terms;
Var S : String[150];
    P : Pointer;
Begin
(DEBUG)
  Put_Text('Time: '+Int_Str(NowTime,1),10,10,15,True);
(DEBUG)
  Convert_Ri_To_Rx(ProblemName);
  If (AStoryRec.HitsINode<>Nil) then
  Begin
    SGName:=AStoryRec.HitsINode^.Who_Am_I^;
    If SGName<>' ' then
      Convert_Ri_to_Rx(SGName)
    end
  else SGName:= '';
  If AStoryRec.NextSINode<>Nil then
  Begin
    NextSGName:=AStoryRec.NextSINode^.Who_Am_I^;
    If NextSGName<>' ' then
      Convert_Ri_To_Rx(NextSGName)
    end
  else NextSGName:= '';
  If (AStoryRec.NowStratPtr<>Nil) then {Plan/Strategy names already set in
actions}
  Begin

```

# FIG. 10A

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## REPRESENTATIVE FLOW CHART FOR COGNITIVE LEARNING

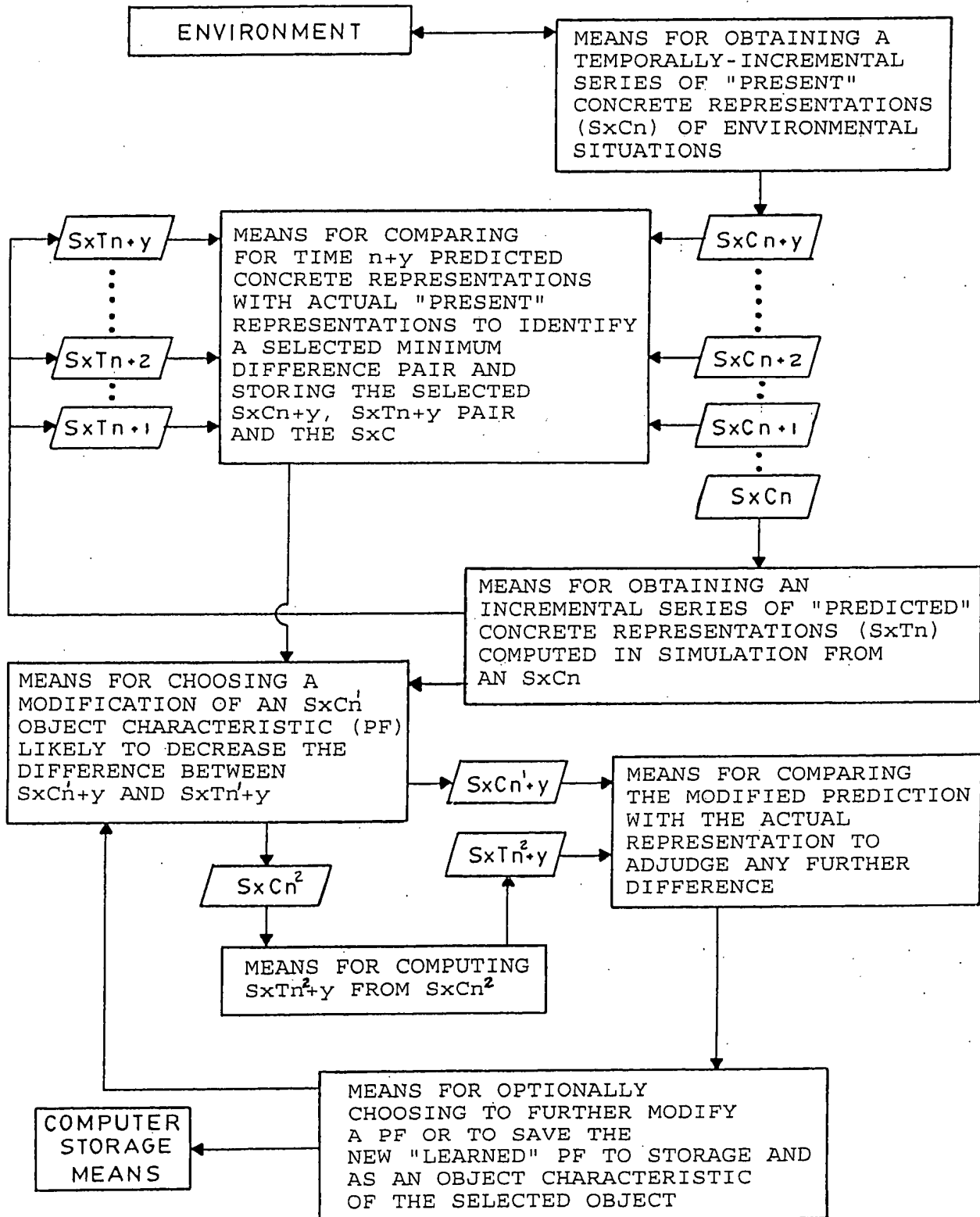


FIG. 21

File View Edit Run Setup Story Brain		
StoryPAL World: Untitled:		
To select behavior, pick up to the stated number from each group:		
<p>Pick one:</p> <p><input type="checkbox"/> Live-animal-like</p> <p><input type="checkbox"/> "-But no metabolism</p> <p><input type="checkbox"/> Live-vegetable-like</p> <p><input type="checkbox"/> Mineral-like</p> <p><input type="checkbox"/> Mixed/other-like</p> <p>Pick zero to 2:</p> <p><input type="checkbox"/> May be eaten</p> <p><input type="checkbox"/> Must eat</p>	<p>Pick no more than one per food chain:</p> <p><input type="checkbox"/> Top 1st food chain</p> <p><input type="checkbox"/> High "</p> <p><input type="checkbox"/> Low "</p> <p><input type="checkbox"/> Bot'm "</p> <p><input type="checkbox"/> Top 2nd food chain</p> <p><input type="checkbox"/> High "</p> <p><input type="checkbox"/> Low "</p> <p><input type="checkbox"/> Bot'm "</p> <p>[Note: StoryPal's type is always Low 1st food chain]</p>	<p>Done</p> <p>Prev</p> <p>Next</p> <p>Page: 1</p>

FIG. 22

File View Edit Run Setup Story Brain		
StoryPAL World: AFRICA		
Select other behavior types if your thing matches the headings:		
<p>As a 'bottom' prey:</p> <p><input type="checkbox"/> Stays in one place</p> <p><input type="checkbox"/> Drifts-</p> <p><input type="checkbox"/> Moves by decision</p> <p>As a 'low' animal:</p> <p><input type="checkbox"/> Safe when at home</p> <p><input type="checkbox"/> Safe when near top</p> <p><input type="checkbox"/> Stores food, low</p> <p><input type="checkbox"/> Group/herd behavior</p> <p>[StoryPal-all above]</p>	<p>As a 'high' animal:</p> <p><input checked="" type="checkbox"/> Avoids home of prey</p> <p><input type="checkbox"/> Group/herd behavior</p> <p>[Note: If you make your thing 'low' or 'high' in BOTH food chains, don't pick group/herd behavior]</p> <p>As a Home for thing:</p> <p><input type="checkbox"/> 'Low' - food chain 1</p> <p><input type="checkbox"/> 'Low' - food chain 2</p>	<p>Done</p> <p>Prev</p> <p>Next</p> <p>Page: 2</p>

FIG. 23

File View Edit Run Setup Story Brain	
StoryPAL World: Untitled	
Select the other types of behavior your thing has:	
Pick no more than 1 from each group:	
<input type="checkbox"/> Poisonable <input type="checkbox"/> Poison-biter  <input type="checkbox"/> Fetch thrown things <input type="checkbox"/> Throws things <input type="checkbox"/> Fetchable thing  <input type="checkbox"/> Storable food <input type="checkbox"/> Mate eats food store	<input type="checkbox"/> Ambushable <input type="checkbox"/> Ambusher <input type="checkbox"/> 1st Ambushing Place <input type="checkbox"/> 2nd Ambushing Place  <input type="checkbox"/> Impaler-like <input type="checkbox"/> Impaler-killable <input type="checkbox"/> Hurls impalers
<div>Done</div> <div>Prev</div> <div>Next</div>	
Page: 3	

FIG. 24

File View Edit Run Setup Story Brain	
StoryPAL World: AFRICA	
Select your thing's relation to humanoids (StoryPAL), if any:	
Pick no more than 1 from this page:	
<input type="checkbox"/> Place for fire/cook <input type="checkbox"/> Picnic food <input type="checkbox"/> Place for picnic <input type="checkbox"/> Place to store food  <input type="checkbox"/> Obstacle-like  <input type="checkbox"/> Player of 'catch' <input type="checkbox"/> Throwable thing <input type="checkbox"/> Fetches thrown thing	<input type="checkbox"/> gardening tool <input type="checkbox"/> Place to store tools <input type="checkbox"/> place for garden <input type="checkbox"/> seed  <input type="checkbox"/> Home <input type="checkbox"/> Food to store @ home  <input type="checkbox"/> Missile-like  <input type="checkbox"/> Hurlable impaler <input checked="" type="checkbox"/> Impalable-killable
<div>Done</div> <div>Prev</div> <div>Next</div>	
Page: 4	

```
[Get_Next_SX] - FantasyTime False
[Deep Thought] - Ctime: 1
Scanning strategy find something to do rfs:
  No rfs present.
Scanning @14 rfs:
  No rfs present.
```

SxC(1): RxName	X	Y	Decision	Speed	Rads	Reason	Situation
StoryPAL	232	214	NIL	0	1.67	MARV	NIL
lion	243	254	race to LowI	0	2.62	RF-SCAN	LowINear
tree	108	50	don't move	0	6.28	RF-SCAN	Anything
native	269	10	wander	0	1.58	RF-SCAN	Anything
rabbit	2	259	explore	0	4.43	RF-SCAN	Anything
rabbit	257	111	explore	0	5.99	RF-SCAN	Anything
deer	441	314	patrol	0	1.84	RF-SCAN	Anything
grass	29	326	don't move	0	5.26	RF-SCAN	Anything
grass	323	347	don't move	0	0.38	RF-SCAN	Anything
grass	335	86	don't move	0	5.83	RF-SCAN	Anything

```
[What_Now_Porpoise] : FantasyTime False
  Problem: @33 [H1]
    Row: 1
    Dsd: @27 [H1] 180 20 2H1
    Reg: TIRED
    Value: 10
```

```
[Set_New_Problem]
[Find_Strategy]
[Find_Starting_Place_In_Strategy] - FantasyTime False
  SUB-P/SG NAME: seeing a struck [HI]
  SUB-P/SG NAME: safe @6 [HomeI]
  SUB-P/SG NAME: safe @6 [TopI]
  SUB-P/SG NAME: near [HI] & at [Imp]
  SUB-P/SG NAME: @8 [HomeI]
  SUB-P/SG NAME: @8 [TopI]
  HIT Strategy
    Strat.: @30 [H1]
    Plan: get @11 @12 [HomeI]
    Row: 2
  SubGoal: @8 [HomeI]
    Row: 1
```

```
[Strat.Make_Decision]
[Predicting_Strategy] Try: 1 of 25
  Trial DSD: @19 @12 [HomeI]
[Get_Next_SX] - FantasyTime True
```

Ending SxT(1): RxName	X	Y	Decision	Speed	Rads	Reason	Situation
StoryPAL	219	197	@19 @12 [HomeI]	21	2.22	MARV	NIL
lion	236	230	race to LowI	24	1.84	RF-SCAN	LowINear
tree	108	50	don't move	0	6.13	RF-SCAN	Anything
native	268	1	wander	10	4.70	RF-SCAN	Anything
rabbit	11	259	explore	10	6.21	RF-SCAN	Anything
rabbit	264	104	explore	10	0.67	RF-SCAN	Anything
deer	435	292	patrol	22	1.84	RF-SCAN	Anything
grass	29	326	don't move	0	0.67	RF-SCAN	Anything
grass	323	347	don't move	0	1.52	RF-SCAN	Anything
grass	335	86	don't move	0	0.00	RF-SCAN	Anything

```
[What_Now_Porpoise] : FantasyTime True
[Next_N_Subgoals_Reached] - FantasyTime True
  SUB-P/SG NAME: safe @6 [HomeI]
  No next(n) subgoal found.
```

```
[Predicting_Strategy] Try: 2 of 25
  Trial DSD: @19 @12 [HomeI]
[Get_Next_SX] - FantasyTime True
```

FIG. 30A-2

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Ending SxT(2):				Speed	Rads	Reason	Situation
RxName	X	Y	Decision				
StoryPAL	206	180	@19 @12 [HomeI]	21	2.22	MARV	NIL
lion	225	208	race to LowI	24	2.05	RF-SCAN	LowINear
tree	108	50	don't move	0	6.13	RF-SCAN	Anything
native	267	10	wander	10	4.70	RF-SCAN	Anything
rabbit	13	268	explore	10	5.01	RF-SCAN	Anything
rabbit	273	104	explore	10	6.27	RF-SCAN	Anything
deer	429	270	patrol	22	1.84	RF-SCAN	Anything
grass	29	326	don't move	0	0.67	RF-SCAN	Anything
grass	323	347	don't move	0	1.52	RF-SCAN	Anything
grass	335	86	don't move	0	0.00	RF-SCAN	Anything

[What\_Now\_Porpoise] : FantasyTime True  
 [Next\_N\_Subgoals\_Reached] - FantasyTime True  
 SUB-P/SG NAME: safe @6 [HomeI]  
 No next(n) subgoal found.

[Predicting Strategy] Try: 3 of 25  
 Trial DSD: @19 @12 [HomeI]  
 [Get\_Next\_SX] - FantasyTime True

Ending SxT(3):				Speed	Rads	Reason	Situation
RxName	X	Y	Decision				
StoryPAL	193	163	@19 @12 [HomeI]	21	2.22	MARV	NIL
lion	211	188	race to LowI	24	2.17	RF-SCAN	LowINear
tree	108	50	don't move	0	6.13	RF-SCAN	Anything
native	266	19	wander	10	4.70	RF-SCAN	Anything
rabbit	16	258	explore	10	1.20	RF-SCAN	Anything
rabbit	265	96	explore	10	2.36	RF-SCAN	Anything
deer	423	248	patrol	22	1.84	RF-SCAN	Anything
grass	29	326	don't move	0	0.67	RF-SCAN	Anything
grass	323	347	don't move	0	1.52	RF-SCAN	Anything
grass	335	86	don't move	0	0.00	RF-SCAN	Anything

[What\_Now\_Porpoise] : FantasyTime True  
 [Next\_N\_Subgoals\_Reached] - FantasyTime True  
 SUB-P/SG NAME: safe @6 [HomeI]  
 No next(n) subgoal found.

[Predicting Strategy] Try: 4 of 25  
 Trial DSD: @19 @12 [HomeI]  
 [Get\_Next\_SX] - FantasyTime True

Ending SxT(4):				Speed	Rads	Reason	Situation
RxName	X	Y	Decision				
StoryPAL	180	146	@19 @12 [HomeI]	21	2.22	MARV	NIL
lion	196	168	race to LowI	24	2.19	RF-SCAN	LowINear
tree	108	50	don't move	0	6.13	RF-SCAN	Anything
native	265	28	wander	10	4.70	RF-SCAN	Anything
rabbit	12	248	explore	10	1.96	RF-SCAN	Anything
rabbit	276	85	move from LowI	16	0.75	RF-SCAN	LowINear
deer	417	226	patrol	22	1.84	RF-SCAN	Anything
grass	29	326	don't move	0	0.67	RF-SCAN	Anything
grass	323	347	don't move	0	1.52	RF-SCAN	Anything
grass	335	86	don't move	0	0.00	RF-SCAN	Anything

[What\_Now\_Porpoise] : FantasyTime True  
 [Next\_N\_Subgoals\_Reached] - FantasyTime True  
 SUB-P/SG NAME: safe @6 [HomeI]  
 No next(n) subgoal found.

[Predicting Strategy] Try: 5 of 25  
 Trial DSD: @19 @12 [HomeI]  
 [Get\_Next\_SX] - FantasyTime True

[What\_Now\_Porpoise] : FantasyTime True  
 [Next\_N\_Subgoals\_Reached] - FantasyTime True  
 SUB-P/SG NAME: safe @6 [HomeI]  
 No next(n) subgoal found.

[Predicting Strategy] Try: 2 of 25  
 Trial DSD: @19 @12 [HomeI]  
 [Get\_Next\_SX] - FantasyTime True

Ending SxT(2):

RxName	X	Y	Decision	Speed	Rads	Reason	Situation
StoryPAL	198	159	@19 @12 [HomeI]	21	2.26	MARV	NIL
lion	217	185	race to LowI	24	2.09	RF-SCAN	LowINear
tree	108	50	don't move	0	6.13	RF-SCAN	Anything
native	266	19	wander	10	4.70	RF-SCAN	Anything
rabbit	19	259	explore	10	5.98	RF-SCAN	Anything
rabbit	272	94	explore	10	5.42	RF-SCAN	Anything
deer	423	257	patrol	19	1.84	RF-SCAN	Anything
grass	29	326	don't move	0	0.67	RF-SCAN	Anything
grass	323	347	don't move	0	1.52	RF-SCAN	Anything
grass	335	86	don't move	0	0.00	RF-SCAN	Anything

[What\_Now\_Porpoise] : FantasyTime True  
 [Next\_N\_Subgoals\_Reached] - FantasyTime True  
 SUB-P/SG NAME: safe @6 [HomeI]  
 No next(n) subgoal found.

[Predicting Strategy] Try: 3 of 25  
 Trial DSD: @19 @12 [HomeI]  
 [Get\_Next\_SX] - FantasyTime True

Ending SxT(3):

RxName	X	Y	Decision	Speed	Rads	Reason	Situation
StoryPAL	184	142	@19 @12 [HomeI]	21	2.26	MARV	NIL
lion	202	165	race to LowI	24	2.20	RF-SCAN	LowINear
tree	108	50	don't move	0	6.13	RF-SCAN	Anything
native	265	28	wander	10	4.70	RF-SCAN	Anything
rabbit	27	253	explore	10	0.60	RF-SCAN	Anything
rabbit	284	83	move from LowI	16	0.72	RF-SCAN	LowINear
deer	417	238	patrol	19	1.84	RF-SCAN	Anything
grass	29	326	don't move	0	0.67	RF-SCAN	Anything
grass	323	347	don't move	0	1.52	RF-SCAN	Anything
grass	335	86	don't move	0	0.00	RF-SCAN	Anything

[What\_Now\_Porpoise] : FantasyTime True

[Next\_N\_Subgoals\_Reached] - FantasyTime True  
 SUB-P/SG NAME: safe @6 [HomeI]  
 No next(n) subgoal found.

[Predicting Strategy] Try: 4 of 25  
 Trial DSD: @19 @12 [HomeI]  
 [Get\_Next\_SX] - FantasyTime True

Ending SxT(4):

RxName	X	Y	Decision	Speed	Rads	Reason	Situation
StoryPAL	170	125	@19 @12 [HomeI]	21	2.26	MARV	NIL
lion	187	146	race to LowI	24	2.23	RF-SCAN	LowINear
tree	108	50	don't move	0	6.13	RF-SCAN	Anything
native	264	37	wander	10	4.70	RF-SCAN	Anything
rabbit	32	261	explore	10	5.25	RF-SCAN	Anything
rabbit	274	82	explore	10	3.09	RF-SCAN	Anything
deer	411	219	patrol	19	1.84	RF-SCAN	Anything
grass	29	326	don't move	0	0.67	RF-SCAN	Anything
grass	323	347	don't move	0	1.52	RF-SCAN	Anything
grass	335	86	don't move	0	0.00	RF-SCAN	Anything

[What\_Now\_Porpoise] : FantasyTime True  
 [Next\_N\_Subgoals\_Reached] - FantasyTime True  
 SUB-P/SG NAME: safe @6 [HomeI]  
 No next(n) subgoal found.



FIG. 29

The Expert System Main Screen Menus

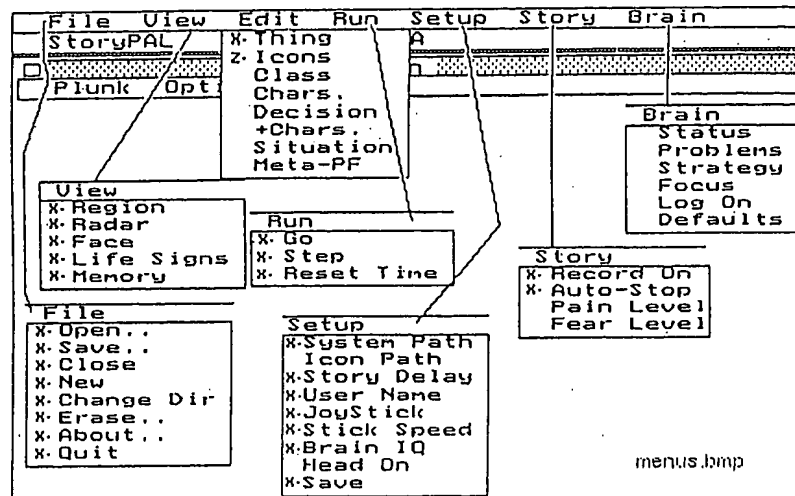
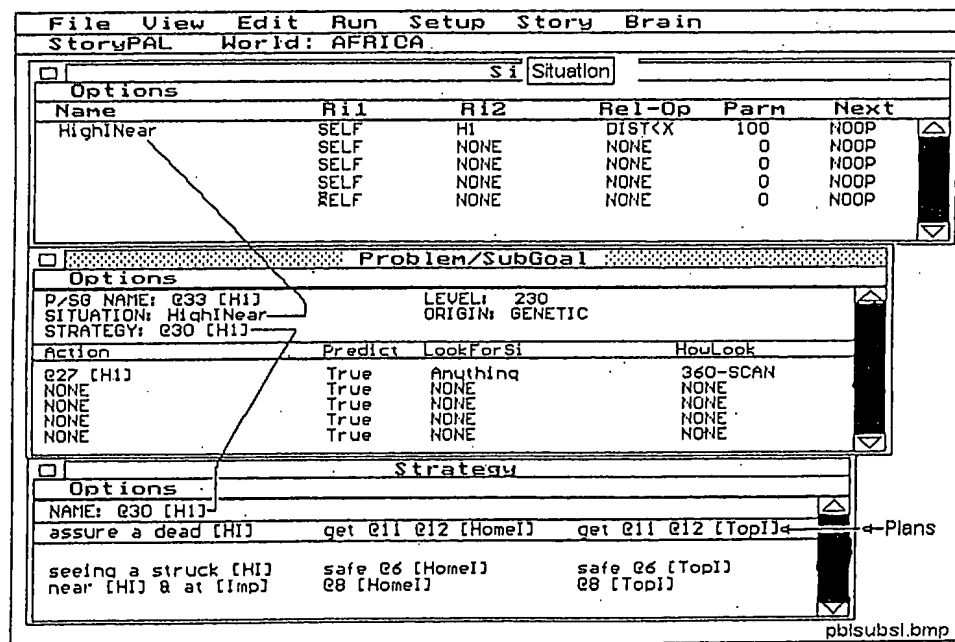


FIG. 31



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# FIG. 32

## SPACIO-TEMPORAL RELATIONSHIPS r IN SOFTWARE EMBODIMENT

Relational Operator	Meaning
NONE	This is the last line. Don't read any further.
DIST>X	The distance between Pi1 (usually the self-object, Ris) and Pi2 is greater than X
DIST<X	The distance between Pi1 and Pi2 is less than X
FASTER	Pi1 is moving faster (more units of distance per Current Situation) than Pi2
SLOWER	Pi1 is moving slower (less units of distance per Current Situation) than Pi2
TOWARD2	Pi1 is moving toward Pi2 ("toward" = Radians in the Parm field. If the angle of movement is less than the Parm field's radians, Toward is True. Zero radians is East or to the Right on the screen)
TOWARD1	Pi2 is moving toward Pi1
AWAYFR2	Pi1 is moving away from Pi2 (parenthetical note on TOWARD2 applies here)
AWAYFR1	Pi2 is moving away from Pi1
>ANGX	The angle between Pi1 and Pi2 exceeds X (X is in radians)
<ANGX	The angle between Pi1 and Pi2 is less than X (X is in radians)
MOVE>X	Pi1 is moving faster than X
<LOCX	Pi1 is at a location whose screen X-coordinate is less than X
>LOCX	Pi1 is at a location whose screen X-coordinate is greater than X
<LOCY	Pi1 is at a location whose screen Y-coordinate is less than Y
>LOCY	Pi1 is at a location whose screen Y-coordinate is greater than Y
1CL2BYX	Pi1 is closer to Pi2 than X units of distance.
1FR2CYX	Pi1 is farther from Pi2 than X units of distance
FEEL	The self Pi is feeling as per what is here set out